

3.3.4 Miscellaneous Group

This group captures those natural communities that have few, if any, common themes that would allow them to fall into one of the other broad natural community groupings. Many of the communities within this group contain highly specialized flora and fauna reflective of the unique environment that they are dependent upon. Seeps, ice, wave action, water level fluctuation and bedrock shaped these communities which support many rare, sometimes regionally endemic species. Included are the more common dry cliff and Great Lakes beach, the ecologically diverse forested ridge and swale, and the extremely rare, highly specialized algific talus slope. Several other often obscure, lesser known natural communities are also included within the Miscellaneous Group.

During the development of the Wisconsin Strategy for Wildlife Species of Greatest Conservation Need, eleven secondary community types were identified for inclusion within the Miscellaneous Group. These communities are listed below.

- Algific Talus Slope (Section 3.3.4.1, Page 3-530)
- Alkaline Clay Bluff (Section 3.3.4.2, Page 3-532)
- Alvar (Section 3.3.4.3, Page 3-534)
- Bedrock Glade (Section 3.3.4.4, Page 3-536)
- Dry Cliff (Section 3.3.4.5, Page 3-543)
- Forested Ridge and Swale (Section 3.3.4.6, Page 3-551)
- Great Lakes Alkaline Rockshore (Section 3.3.4.7, Page 3-558)
- Great Lakes Beach (Section 3.3.4.8, Page 3-560)
- Great Lakes Dune (Section 3.3.4.9, Page 3-565)
- Inland Beach (Section 3.3.4.10, Page 3-570)
- Moist Cliff (Section 3.3.4.11, Page 3-573)

Summary of Vertebrate Species
of Greatest Conservation Need
Associated with Miscellaneous
Communities

27 Birds
9 Herptiles
3 Mammals

39 Total Species

The vertebrate Species of Greatest Conservation Need in each of these communities are presented in the following sections, along with information on opportunities, threats, and priority conservation actions.

3.3.4.1 Algific Talus Slope

3.3.4.1.1 Community Overview

This rare community is known only from the southwestern corner of Wisconsin's Driftless Area. Algific talus slopes are small and isolated and tend to occur on steep north- or east-facing slopes with a substrate of fractured limestone (dolomite) bedrock that retains ice and emits cold air throughout the growing season. The community is dependent on water entering gaps in the dolomite, freezing in winter, and then slowly melting during the summer months and producing a steady outflow of cold air. Cold microhabitats support and enable the persistence of disjunct northern plant species, and "periglacial relicts" such as northern monkshood and globally rare terrestrial snails. The woody overstory is often sparse, composed of scattered, small black ash and white birch. Mountain maple, a northern shrub, may be frequent, and extensive beds of bulblet fern and mosses are characteristic herbs.

3.3.4.1.2 Vertebrate Species of Greatest Conservation Need Associated with Algific Talus Slope

There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately or significantly associated with algific talus slopes.

3.3.4.1.3 Threats and Priority Conservation Actions for Algific Talus Slope

All known occurrences of algific talus slope are in the Western Coulee and Ridges Ecological Landscape in western Grant County and are within a few miles of the Mississippi River. As a result, the Western Coulee and Ridges Ecological Landscape represents a major opportunity for protection, management, and/or restoration of algific talus slope.

The largest, most diverse sites remain in private ownership. Because of the fragility of the type and out of respect to landowners' wishes, public visitation is not recommended or encouraged at this time. Though past searches for algific talus slopes have been quite rigorous (e.g., over 95 sites were examined in Grant County alone in 1985), it is possible that additional occurrences of this community could exist in areas that have not yet been surveyed.

The following list of threats and priority conservation actions were identified for algific talus slope in Wisconsin.

Threats and Issues

- Loss of forest cover can result in desiccation, as well as the loss of leaf litter that is required by the snails as a food source.
- Excessive trampling can harm sensitive vegetation and animal life and can affect water infiltration by compacting the substrate.
- Physical damage to the surface can occur due to quarrying, and less intense disturbances such as passage by livestock, vehicles, or even humans travelling on foot.
- Altered hydrology can result from road construction, quarrying, or building structures above the slopes.
- The impacts of invasive species are unknown and don't appear to be major at this time, but a monitoring program is necessary to periodically check for the presence of invasives.

Priority Conservation Actions

- Ensure the maintenance of hydrologic function and carefully consider management of the lands around the algific talus slope.

- Protective actions need to include not only the areas from which cold air flows to the surface, but also those areas up slope that permit the infiltration of water that freezes in bedrock fissures and cavities during winter.

3.3.4.2 Alkaline Clay Bluff

3.3.4.2.1 Community Overview

Steep clay bluffs border stretches of the Great Lakes shorelines, and are less commonly found inland on the lower portions of streams draining into Lakes Superior and Michigan. Vegetative cover can range from dense forests of red pine, white pine, northern white cedar, and white birch, to bare clay with only a few weedy herbs present. Buffaloberry is a characteristic shrub, but more typically, alders (*Alnus incana* and *A. crispa*), as well as rank herbs such as Canada goldenrod and pearly everlasting are dominant. Both native and exotic pioneers such as fireweed and Canada thistle are common, especially on the more unstable sites.

It is the semi-stabilized “weeping” bluffs that are of the greatest biological interest. Golden sedge, gentians, orchids, and calciphilic fen species may colonize such sites, which can be local repositories of rare or otherwise noteworthy plant species.

Henry Chandler Cowles, regarded as the founder of plant ecology, studied this bluff environment at the end of the 19th century (as part of his work on the Lake Border moraines, primarily in Illinois where private ownership now limits access.) He noted "there can be almost no other habitat in our climate which imposes such severe conditions upon vegetation as an eroding clay bluff." Temperature extremes, sun and wind exposure, and the variable consistency of clay soils (from mush to concrete as they dry) severely inhibit establishment by pioneer plants. During periods of erosion, Cowles felt "all vegetation is impossible."

3.3.4.2.2 Vertebrate Species of Greatest Conservation Need Associated with Alkaline Clay Bluff

There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately or significantly associated with alkaline clay bluff.

3.3.4.2.3 Threats and Priority Conservation Actions for Alkaline Clay Bluff

3.3.4.2.3.1 Statewide Overview of Threats and Priority Conservation Actions for Alkaline Clay Bluff

The following list of threats and priority conservation actions were identified for alkaline clay bluff in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.2.3.2 unless otherwise indicated.

Threats and Issues

- Protection of bluff hydrology is critical, so that neither too much nor too little water is moving through or across them.
- Development on the bluffs has been intensive in some areas, such as southeastern Wisconsin. This has contributed to bluff destabilization, and some of the structural solutions that have been implemented to control or retard erosion have totally destroyed the unique habitats present.
- Construction activities can easily disrupt steep slopes and accelerate erosion, which once begun, can be difficult to stop.
- Forest management on areas bordering the semi-stable patches has to be done with extreme care to avoid damage or hydrologic alteration.
- Because of the inherent disturbance associated with this type, there are opportunities for colonization by many invasive species.

Priority Conservation Actions

- Protect alkaline clay bluffs from damage caused by vehicles and foot travel.
- Use comprehensive land use planning to limit additional development of hilltops at important sites.
- Plan at the watershed level to protect hydrology and limit damaging peak flows that often occur during spring snowmelt.
- Educate the public regarding the ecological values of this community type.
- Work with private landowners to encourage their protection of ecologically valuable sites.

3.3.4.2.3.2 Additional Considerations for Alkaline Clay Bluff by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of alkaline clay bluff exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for alkaline clay bluff found in Section 3.3.4.2.3.1.

Additional Considerations for Alkaline Clay Bluff in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

This community is very limited in geographic scope and no major opportunities for protection remain.

Additional Considerations for Alkaline Clay Bluff in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Clay ravines that open to the Lake Michigan shore should be surveyed thoroughly to assess those sites that are most intact and support rare species. Fairy Chasm State Natural Area (Ozaukee County) and Fischer Creek State Recreation Area (Manitowoc County) contain examples of this community. Deer damage is severe in this Ecological Landscape and shoreline development limits conservation opportunities. The county management of one mile of state-owned shoreline near the mouth of Fischer Creek will potentially provide a good degree of protection to the bluffs at that site.

Northern Lake Michigan Coastal

Opportunities are few here, scattered among privately owned, localized sites near lower Green Bay or along Lake Michigan.

Southern Lake Michigan Coastal

Examples of alkaline clay bluff may be found in Milwaukee and Racine counties. Cliffside Park (Racine County) may be the best place to see the Lake Border moraines as they tower above the blue waters of Lake Michigan. Here the eroding clay bluffs are slowly entering the earliest stages of ravine formation, providing an opportunity to witness a dynamic landscape process in an urban area. Localized stretches of the clay bluffs in southern Milwaukee County (e.g., Warnimont Park) support rare plants.

Superior Coastal Plain

Continuing interest in permanent and seasonal home development and other construction along the Lake Superior shoreline may pose a threat to this community here, but there are some protected examples on public lands near the City of Superior. Past logging practices have badly damaged many of the clay bluffs in this region, which still exhibit signs of severe disturbance.

3.3.4.3 Alvar

3.3.4.3.1 Community Overview

This rare community consists of areas of thin, discontinuous soil overlying horizontal beds of limestone or dolomite in the vicinity of Great Lakes shorelines. These communities support an unusual blend of boreal and prairie species, which appear to be relicts of the cold period following the last glaciers and of the warmer, drier period that followed. They are characterized by relatively low tree cover and a distinctive biota which includes elements of rock pavement, prairie, savanna and boreal forest communities. Among these are regional endemics, some of which are globally very rare. This community type is much more common and better developed in Michigan and Ontario than in Wisconsin.

Small coniferous and deciduous trees such as northern white cedar, balsam fir, pines, oaks, aspens, and white birch are scattered among an assemblage of species that can include big bluestem, little bluestem, Indian-grass, and wood lily, as well as shoreline plants such as silverweed and dwarf lake iris. One species, lakeside daisy, occurs nowhere else in the world except on Great Lakes alvars and several isolated places in Illinois. Alvars are home to an unusual set of wildlife species as well, including the loggerhead shrike and a large number of distinctive invertebrates such as leaf-hoppers and land snails.

3.3.4.3.2 Vertebrate Species of Greatest Conservation Need Associated with Alvar

There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately or significantly associated with alvar.

3.3.4.3.3 Threats and Priority Conservation Actions for Alvar

3.3.4.3.3.1 Statewide Overview of Threats and Priority Conservation Actions for Alvar

The following list of threats and priority conservation actions were identified for alvar in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.3.3.2 unless otherwise indicated.

Threats and Issues

- Many of these sites are on private land, and their quality can be seriously threatened by the increasing encroachment of developments, and to a lesser extent by quarrying.
- Plant collection, such as the "harvesting" of stunted trees by bonsai collectors, is also a threat in some areas.
- Some sites are being altered and colonized by woody species, such as eastern red cedar and the invasive plant Tartarian honeysuckle.

Priority Conservation Actions

- Minimize adverse impacts from quarrying, residential development and unregulated plant collection on significant sites.
- Thin sites with dense woody species cover to maintain rare plant populations and community structure.
- Control and eradicate, when possible, invasive species such as Tartarian honeysuckle.

3.3.4.3.3.2 Additional Considerations for Alvar by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of alvar exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for alvar found in Section 3.3.4.3.3.1.

Additional Considerations for Alvar in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Red Banks Escarpment and Glades (Brown County) is the most prominent alvar community in Wisconsin. This site contains one of the most diverse snail communities known in the Midwest and is one of the most important areas in Wisconsin for land snails. Colonies of 25 different groups of glacial relict snails can be found from the base to the top of the escarpment. Of interest are the number of rare and glacial relict snail taxa that are present including the cherrystone drop and the Midwest Pleistocene vertigo snail.

Additional Considerations for Alvar in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Northern Lake Michigan Coastal

Idlewild Alvar (Door County) is a lower quality site that may nonetheless offer some potential conservation opportunity.

3.3.4.4 Bedrock Glade

3.3.4.4.1 Community Overview

Bedrock glades are xeric, sparsely vegetated, non-vertical bedrock exposures, with thin, often discontinuous soils. The rock types vary from quartzite (Baraboo Hills, McCaslin Mountain), to basalt (lower St. Croix River valley), to granite (northeastern Wisconsin). The flora can include prairie, savanna, or barrens components, some of them reaching their northern range limits in this community type, as well as bare rock specialists. Tree and shrub cover is usually sparse, and often has structural similarities to a thinly timbered savanna or woodland habitat. Important woody species may include pines, oaks, hickories, and cherries, along with dogwood, hazelnuts, prairie willow, and ericads such as huckleberry. Xerophytic pteridophytes such as rusty woodsia, northern fragile fern, and rock spikemoss are characteristic plants, as are lichens and mosses. Glades have apparently served as refugia for light-demanding species that are adapted to the more open savanna and prairie conditions that were formerly much more abundant and widespread in parts of Wisconsin. Many uncommon plant species usually associated with these habitats were documented in the glades of the Baraboo Hills.

3.3.4.4.2 Vertebrate Species of Greatest Conservation Need Associated with Bedrock Glade

Eight vertebrate Species of Greatest Conservation Need were identified as moderately or significantly associated with bedrock glade. Those eight species are shown in Table 3-99.

Table 3-99. Vertebrate Species of Greatest Conservation Need that are (or historically were) moderately or significantly associated with bedrock glade communities.

<i>Species Significantly Associated with Bedrock glade</i>
Herptiles
Northern Prairie Skink
Prairie Ringneck Snake
Bullsnake
Western Ribbon Snake
<i>Species Moderately Associated with Bedrock glade</i>
Birds
Whip-poor-will
Blue-winged Warbler
Herptiles
Prairie Racerunner
Timber Rattlesnake

In order to provide a framework for decision-makers to set priorities for conservation actions, the species identified in Table 3-99 were subject to further analysis. The additional analysis identified the best opportunities, by Ecological Landscape, for protection, restoration, and/or management of both bedrock glade and associated vertebrate Species of Greatest Conservation Need. The steps of this analysis were:

- Each species was examined relative to its probability of occurrence in each of the 16 Ecological Landscapes in Wisconsin. This information was then cross-referenced with the opportunity for protection, restoration, and/or management of bedrock glade in each of the Ecological Landscapes (Tables 3-100 and 3-101).
- Using the analysis described above, a species was further selected if it had both a significant association with bedrock glade and a high probability of occurring in an Ecological Landscape(s) that

represents a major opportunity for protection, restoration and/or management of bedrock glade. These species are shown in Figure 3-18.

Table 3-100. Vertebrate Species of Greatest Conservation Need that are (or historically were) significantly associated with bedrock glade communities and their association with Ecological Landscapes that support bedrock glade.

Bedrock Glade Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type	Herptiles (4)*			
	Northern Prairie Skink	Prairie Ringneck Snake	Bullsnake	Western Ribbon Snake
MAJOR				
Western Coulee and Ridges				
IMPORTANT				
Central Sand Hills				
Forest Transition				
Western Prairie				
PRESENT (MINOR)				
Central Sand Plains				

Color Key

= HIGH probability the species occurs in this Ecological Landscape

= MODERATE probability the species occurs in this Ecological Landscape

= LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Table 3-101. Vertebrate Species of Greatest Conservation Need that are (or historically were) *moderately* associated with bedrock glade communities and their association with Ecological Landscapes that support bedrock glade.

Bedrock Glade Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type	Birds (2)*		Herptiles (2)	
	Whip-poor-will	Blue-winged Warbler	Prairie Racerunner	Timber Rattlesnake
MAJOR				
North Central Forest				
Western Coulee and Ridges				
IMPORTANT				
Central Lake Michigan Coastal				
Central Sand Hills				
Forest Transition				
Western Prairie				
PRESENT (MINOR)				
Central Sand Plains				
Northern Highland				
Northern Lake Michigan Coastal				
Northwest Lowlands				

Color Key

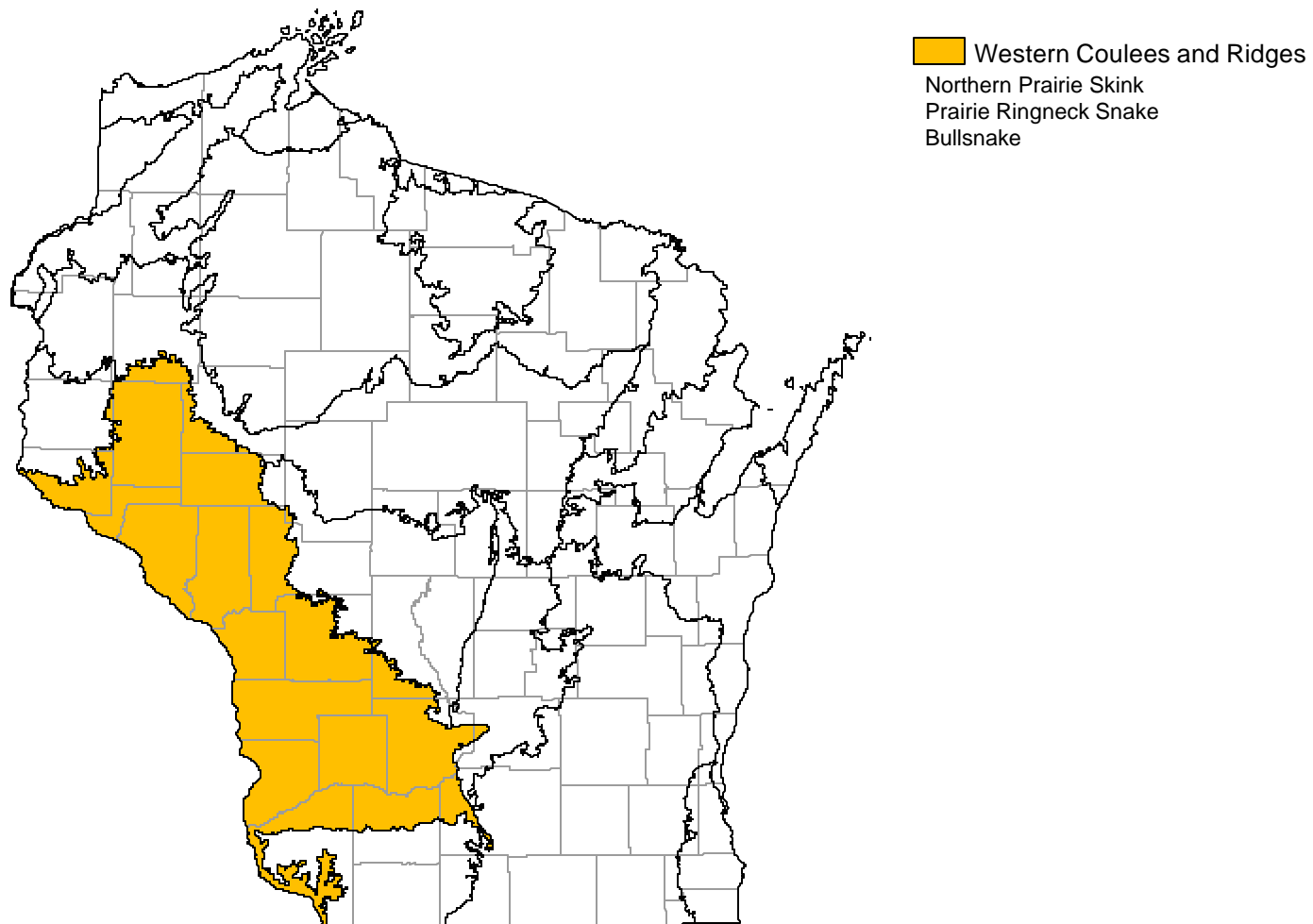
= HIGH probability the species occurs in this Ecological Landscape

= MODERATE probability the species occurs in this Ecological Landscape

= LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Figure 3-18. Vertebrate Species of Greatest Conservation Need that have both a significant association with bedrock glade and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of bedrock glade.



3.3.4.4.3 Threats and Priority Conservation Actions for Bedrock Glade

3.3.4.4.3.1 Statewide Overview of Threats and Priority Conservation Actions for Bedrock Glade

The following list of threats and priority conservation actions were identified for bedrock glade in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.4.3.2 unless otherwise indicated.

Threats and Issues

- Mining could pose a threat in areas bearing metallic minerals within the underlying bedrock. Non-metallic mining can also pose a threat to this community.
- Unsustainable grazing can disturb thin soils and impact plant communities.
- Off-road vehicles and heavy foot traffic can destroy fragile organisms such as lichens. The recovery times for vegetation can be exceedingly long in these dry, nutrient poor habitats.
- Lack of fire can result in establishment and/or expansion of woody species such as eastern red cedar and excessive shading of the herbaceous and low shrub vegetation. However, frequent fire is undesirable if fire sensitive organisms are known or suspected of occurring at a given site. It may, in fact, be impossible to burn because of low fuel loads and the difficulty of running fire through areas with sparse vegetation and exposures of bare rock.
- Non-native invasive plant species can replace native species.

Priority Conservation Actions

- Acquire surface and subsurface mineral rights.
- Provide incentives to limit grazing.
- Protect sites from off-road vehicle use and heavy foot traffic.
- Manage with a combination of prescribed fire and mechanical methods to remove cedar and other undesirable species as needed. Where possible, manage in habitat mosaics. Depending on the region of the state, these might include cliffs, dry prairies, savannas, and a variety of dry forest communities.
- Monitor for presence of invasive species and respond as deemed necessary.
- Additional surveys for rare plants and animals are needed in most areas where glade vegetation occurs.

3.3.4.4.3.2 Additional Considerations for Bedrock Glade by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of bedrock glade exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for bedrock glade found in Section 3.3.4.4.3.1.

Additional Considerations for Bedrock Glade in Ecological Landscapes with *Major* Opportunities for Protection, Restoration, and/or Management

North Central Forest

Much of Northern Wisconsin is underlain by pre-Cambrian granite. "Glades" are uncommon in this heavily forested region but they do occur along several rivers (e.g., the Wolf), on some of the bedrock knobs and mounds in the Chequamegon-Nicolet National Forest, and on the Penokee Range found within the Iron County Forest.

Western Coulee and Ridges

The Baraboo Hills harbors many bedrock glades, with most of them occurring on quartzite. Glade management can be incorporated into parcel-level and landscape-scale management plans for the area on public lands such as Devils Lake State Park and nearby privately owned lands that are managed at least partially for conservation purposes. Examples from the Baraboo Hills include the Caledonia Glades and Devil's Nose, both in Sauk County.

Additional Considerations for Bedrock Glade in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Central Sand Hills

Some outcrops of shallow bedrock exist here. Bedrock glade communities exist in places such as the abandoned Badger Army Ammunition Plant. A management plan for state property at this site will likely be developed once transfer from the federal government is completed. This may open some of these areas to visitation, and increased foot traffic, and could impact the plant and lichens assemblages, which are vulnerable to damage. Some of the flat-topped sandstone bedrock features at Mill Bluff State Park (Monroe and Juneau Counties) also support glade vegetation.

Forest Transition

McCaslin Mountain is underlain with quartzite and hosts glade communities that can be managed on national forest lands. The greatest concentrations of glades in this Ecological Landscape are along the Lower St. Croix River, in and around Interstate State Park (Polk County). An example of this community can also be found at Butler's Rock within the Oconto County Forest.

Western Prairie

Some bedrock glade occurrences exist in the lower St. Croix Valley, over basalt bedrock. Osceola Glade, in Polk County, is the best known example.

3.3.4.5 Dry Cliff

3.3.4.5.1 Community Overview

In most of Wisconsin the bedrock is buried beneath glacial materials that were deposited during the Pleistocene Ice Age. In glaciated regions, cliffs are associated with certain stretches of the Great Lakes coasts, stream-carved gorges, and the vestigial remnants of ancient, eroded mountain ranges and escarpments. In the “Driftless Area” of southwestern Wisconsin the mantle of glacial drift is absent and erosion has exposed sedimentary bedrock of Paleozoic age at many locations, most often as a linear series of vertical cliffs.

By definition, a cliff is a geologic feature, not a plant community, which can occur on virtually any rock type. Rock type, exposure, surrounding land cover and other factors create a wide variety of environmental conditions that may influence species composition. The presence or absence of fractures and other features that may hold soil particles and moisture, or the alternation of strata composed of different rock types that have different properties, can affect habitat suitability for plants and animals.

A greater proportion of limestone (dolomite) cliff sites tend to be dry, compared to sandstone cliff sites, due to the potential for capillary action in sandstone to hold and slowly transport the water that is essential for plant survival. A soil profile is generally absent, or may occur as localized, usually thin deposits on ledges or in cracks. Dry cliffs may be influenced by aspect, local hydrology, or the proximity of waterbodies. Series of dry cliffs may include stretches or patches that are moist, and these often support additional species. The separation of “dry” from “moist” cliffs can be somewhat artificial, and the totality of the environment should be considered when assessing conservation values and opportunities.

Dry cliff communities occur on many different rock types, and vary in species composition. Scattered pines, oaks, cedars, and drought-adapted shrubs such as bush honeysuckle and huckleberry, often occur on the margins of the exposed rock, or where mineral soil has accumulated on ledges or in fissures. Floristic homogeneity between cliffs is typically rather low, but representative herbs may include the ferns common polypody, smooth cliff brake, rusty woodsia, and northern fragile fern, along with columbine, harebell, sand cress, sleepy catchfly, pale corydalis, and rock spikemoss. Dry cliffs are frequently colonized by crustose lichens, which may be the most common inhabitants of bare rock environments for decades or even centuries.

Plant species composition is strongly influenced by the plant community in the immediate vicinity of the cliff, but also includes bare rock specialists, among which are some of Wisconsin's most dramatic examples of disjunct species. An example of a disjunct species is the population of Lapland rose-bay that grows on a sandstone cliff along the Wisconsin River in the Central Sand Plains. One other population of this species is known from Wisconsin, but the next closest population is on an Adirondack mountaintop in rural New York.

Cliffs are used for denning and roosting by mammals, for nesting and roosting by birds, as hibernacula by herptiles, and also provide suitable conditions for specialized invertebrates. Besides insects, the latter group includes several very rare terrestrial gastropods.

3.3.4.5.2 Vertebrate Species of Greatest Conservation Need Associated with Dry Cliff

Six vertebrate Species of Greatest Conservation Need were identified as moderately or significantly associated with dry cliff (Table 3-102).

Table 3-102. Vertebrate Species of Greatest Conservation Need that are (or historically were) moderately or significantly associated with dry cliff communities.

<i>Species Significantly Associated with Dry Cliff</i>	
Birds	
Peregrine Falcon	
Herptiles	
Black Rat Snake	
Bullsnake	
Timber Rattlesnake	
<i>Species Moderately Associated with Dry Cliff</i>	
Herptiles	
Northern Prairie Skink	
Yellow-bellied Racer	




In order to provide a framework for decision-makers to set priorities for conservation actions, the species identified in Table 3-102 were subject to further analysis. The additional analysis identified the best opportunities, by Ecological Landscape, for protection, restoration, and/or management of both dry cliff and associated vertebrate Species of Greatest Conservation Need. The steps of this analysis were:

- Each species was examined relative to its probability of occurrence in each of the 16 Ecological Landscapes in Wisconsin. This information was then cross-referenced with the opportunity for protection, restoration, and/or management of dry cliff in each of the Ecological Landscapes (Tables 3-103 and 3-104).
- Using the analysis described above, a species was further selected if it had both a significant association with dry cliff and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of dry cliff. These species are shown in Figure 3-19.

Table 3-103. Vertebrate Species of Greatest Conservation Need that are (or historically were) significantly associated with dry cliff communities and their association with Ecological Landscapes that support dry cliff.

Dry Cliff Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type	Birds (1)*	Herptiles (3)		
	Peregrine Falcon	Black Rat Snake	Bullsnake	Timber Rattlesnake
MAJOR				
Central Lake Michigan Coastal				
Central Sand Plains				
Northern Lake Michigan Coastal				
Superior Coastal Plain				
Western Coulee and Ridges				
IMPORTANT				
Southwest Savanna				
Western Prairie				
PRESENT (MINOR)				
Central Sand Hills				
Southern Lake Michigan Coastal				

Color Key




-  = HIGH probability the species occurs in this Ecological Landscape
-  = MODERATE probability the species occurs in this Ecological Landscape
-  = LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Table 3-104. Vertebrate Species of Greatest Conservation Need that are (or historically were) *moderately* associated with dry cliff communities and their association with Ecological Landscapes that support dry cliff.

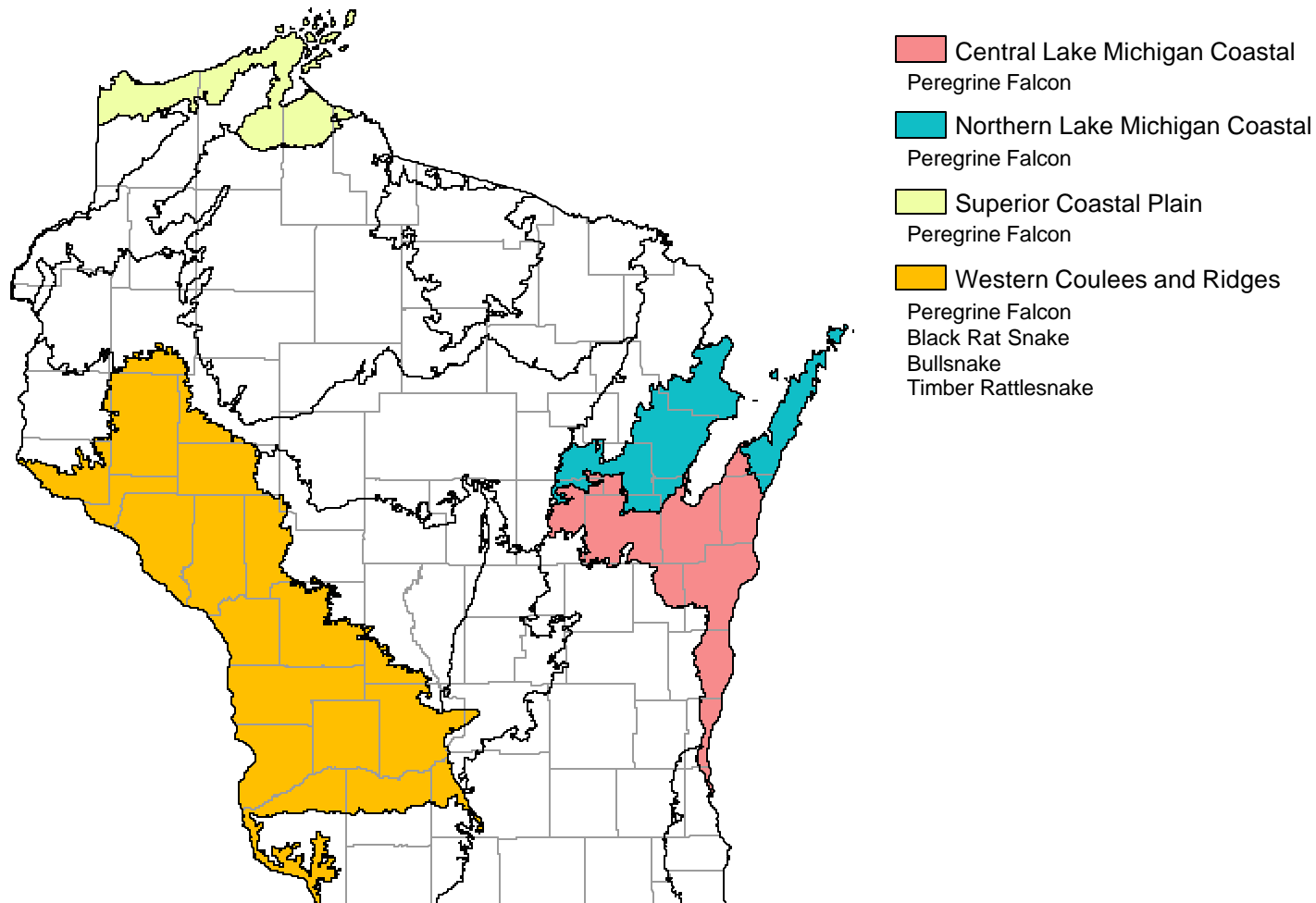
Dry Cliff	Herptiles (2)*	
	Northern Prairie Skink	Yellow-bellied Racer
Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type		
MAJOR		
Central Sand Plains		
Southeast Glacial Plains		
Western Coulee and Ridges		
IMPORTANT		
Forest Transition		
Southwest Savanna		
Western Prairie		
PRESENT (MINOR)		
Central Sand Hills		

Color Key

-  = HIGH probability the species occurs in this Ecological Landscape
-  = MODERATE probability the species occurs in this Ecological Landscape
-  = LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Figure 3-19. Vertebrate Species of Greatest Conservation Need that have both a significant association with dry cliff and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of dry cliff.



3.3.4.5.3 Threats and Priority Conservation Actions for Dry Cliff

3.3.4.5.3.1 Statewide Overview of Threats and Priority Conservation Actions for Dry Cliff

The following list of threats and priority conservation actions were identified for dry cliff in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.5.3.2 unless otherwise indicated.

Threats and Issues

- Quarrying by its nature destroys cliffs and the vegetation and microsites that are associated with them; however, quarrying operations can create new vertical rock faces.
- The construction of dams has led to the inundation of cliffs in some parts of the state, especially in the Western Coulees and Ridges Ecological Landscape.
- Grazing, fire, logging, road building, off-road vehicle use, home construction, and heavy foot traffic (specifically, rock climbing) can also be disruptive and degrade cliff habitats.
- The impacts of invasive species are unknown, but warrant further investigation.
- Some associated snail species are globally rare.
- The best sites outside of state parks are privately owned.

Priority Conservation Actions

- Additional surveys are needed to better establish the ecological values of cliffs in some parts of the state.
- Cliffs for which ecological values have been documented should be protected, and managed with care.
- Additional surveys are needed, especially for taxa that are poorly known (lichens, mosses, invertebrates), to clarify and establish the values of cliff habitats in many parts of the state.
- A better understanding of the effects that rock type, aspect, geographic location, total area of rock exposed, and landscape context have on cliff biota is needed to effectively address conservation needs and opportunities.
- Limit or avoid rock climbing and other disruptive activities on high-value sites.
- Landowner education may help guide extractive and high-impact recreational activities to areas of relatively low value.
- Protection of high-value sites should be encouraged, especially on privately owned lands.
- Surveys should be continued to search for additional sites of high conservation value.

3.3.4.5.3.2 Additional Considerations for Dry Cliff by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of dry cliff exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for dry cliff found in Section 3.3.4.5.3.1.

Additional Considerations for Dry Cliff in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Ecologically important stretches of the dolomitic Niagara Escarpment occur along the east side of the Fox River Valley, north of Lake Winnebago, and in northeastern Brown County, near Red Banks.

Central Sand Plains

Unglaciated exposures of Cambrian sandstones are uncommon but prominent features in this landscape, where they occur in association with eroded landforms such as ridges, mounds, knobs, and pinnacles, some of which are very unusual in the Midwest. Good examples occur at Mill Bluff State Park (Monroe County), in stream gorges and elsewhere on the Black River State Forest (Jackson County), and at Quincy Bluff and Wetlands State Natural Area (Adams County).

North Central Forest

Bedrock features are scarce and localized here except in the Penokee Range, on the landscape's northern fringe, where there are a number of dry cliffs and "balds" (bedrock glades). There are also a few cliff sites in the eastern part of the Ecological Landscape. Examples can be found on the Iron County Forest (basalt), along the Montreal River (also Iron County) and on the Chequamegon-Nicolet National Forest (e.g., McCaslin Mountain, a quartzite monadnock in Forest County).

Northern Lake Michigan Coastal

Cliffs of the dolomitic Niagara Escarpment are striking landscape features on the west side of the Door Peninsula. Examples can be found at Peninsula and Potawatomi State Parks, Ellison Bay Bluff State Natural Area, and Death's Door County Park.

Superior Coastal Plain

Wave-carved sandstone cliffs are found on rocky headlands along the northern margin of the Bayfield Peninsula, and along the coasts of some of the Apostle Islands (including North Twin Island and Stockton Island Cliffs). Separation of dry from wet cliffs is difficult, and perhaps artificial, as even the driest bedrock associated with the Lake Superior coast may be bathed in fogs or subject to wave spray during storms.

Western Coulee and Ridges

Sandstones and dolomites of Paleozoic age outcrop at many locations, most extensively in the valleys formed by large rivers such as the Mississippi, Wisconsin, Chippewa and Black. The many good examples include Ferry Bluff (Sauk County), the Kickapoo Reserve and Wildcat Mountain State Park (Vernon County), and Maiden Rock Bluff (Pepin County).

Additional Considerations for Dry Cliff in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Forest Transition

Rock outcroppings provide some cliff habitat in places such as the Dells of the Eau Claire River County Park, and Rib Mountain State Park, both in Marathon County.

Northeast Sands

Bedrock exposures are uncommon features in the Northeast Sands. They do occur along some of the high gradient streams in the landscape such as the Menominee and Peshtigo, and in association with isolated geologic rock features such as Butler Rock (Oconto County), Thunder Mountain (Marinette County), The Dalles of the Menominee River (Marinette County), and Hagar Mountain (Oconto County).

Southern Lake Michigan Coastal

The youngest bedrock exposures in Wisconsin are dolomites of Devonian age, which outcrop as low cliffs and ledges at a few locations near Lake Michigan. Examples may be seen at several locations within the Milwaukee County Park system, such as at Estabrook Park.

Southwest Savanna

Stream cut valleys expose Paleozoic sandstones and dolomites at sites such as Governor Dodge State Park, where the park's trail system permits close examination of the bedrock.

Western Prairie

Significant bedrock exposures of dolomite and sandstone occur at Kinnickinnic and Willow River State Parks, Apple River Canyon State Natural Area, and at locations in Polk County within the St. Croix-Namekagon National Scenic Riverway.

3.3.4.6 Forested Ridge and Swale

3.3.4.6.1 Community Overview

This community complex is associated closely with Great Lakes shorelines. Series of narrow sandy ridges alternate with low swales, parallel to the lakeshore. The vegetation on the dry ridges can vary from open herbaceous or shrub communities on the semi-stabilized dunes closest to the shoreline, dry forests dominated by pines and oaks farther inland, and mixed mesophytic forests of northern hardwoods or hemlock hardwoods farthest from the shore. In a few locations, some of the ridges may support a boreal forest association that includes pines, white spruce, balsam fir, and paper birch. This may be at least partially due to the influence of the Great Lakes on local climate, creating conditions that are relatively cool and moist during the growing season. For additional details on specific upland communities associated with *forested ridge and swale* see northern dry forest (Section 3.3.5.2), northern dry-mesic forest (3.3.5.3), and northern mesic forest (3.3.5.5). Great Lakes dune (Section 3.3.4.9), while not a forest community, sometimes occupies the open beach ridges nearest the shoreline.

Water depth is a controlling factor in the swales, which are typically deeper and more open near the shoreline, supporting marsh or sedge meadow communities. Farther away from the lake, an alder-dominated shrub community may develop, and still farther inland forested wetlands of swamp hardwoods, bog conifers, or northern white cedar may be present. Only the deepest swales closest to the shore may be in contact with Great Lakes water. Most of the swales receive water via small streams or groundwater seepage from areas upslope. The wetland communities that might be part of this complex include submergent aquatic (Section 3.3.8.15), emergent aquatic (Section 3.3.8.6), interdunal wetland (Section 3.3.8.10), alder thicket (Section 3.3.8.1), northern wet forest (Section 3.3.5.6), northern wet-mesic forest (Section 3.3.5.7), and northern hardwood swamp (Section 3.3.5.4).

In Wisconsin, this community complex is best developed along Lake Michigan. The parallel ridges and swales offer exceptionally complex and diverse habitats for wetland, upland, and Great Lakes shoreline plants, and support rich assemblages of amphibians, reptiles, and breeding and migratory birds. A few ridge and swale systems occur on the Lake Superior coast.

3.3.4.6.2 Vertebrate Species of Greatest Conservation Need Associated with Forested Ridge and Swale

Eleven vertebrate Species of Greatest Conservation Need were identified as moderately or significantly associated with forested ridge and swale (Table 3-105).

Table 3-105. Vertebrate Species of Greatest Conservation Need that are (or historically were) moderately or significantly associated with forested ridge and swale communities.

<i>Species Significantly Associated with Forested Ridge and Swale</i>	
Birds	
Canada Warbler	
Herptiles	
Four-toed Salamander	
<i>Species Moderately Associated with Forested Ridge and Swale</i>	
Birds	
Solitary Sandpiper	
Black-billed Cuckoo	
Olive-sided Flycatcher	
Least Flycatcher	
Veery	
Wood Thrush	
Brown Thrasher	
Rusty Blackbird	
Mammals	
Northern Flying Squirrel	




In order to provide a framework for decision-makers to set priorities for conservation actions, the species identified in Table 3-105 were subject to further analysis. The additional analysis identified the best opportunities, by Ecological Landscape, for protection, restoration, and/or management of both forested ridge and swale and associated vertebrate Species of Greatest Conservation Need. The steps of this analysis were:

- Each species was examined relative to its probability of occurrence in each of the 16 Ecological Landscapes in Wisconsin. This information was then cross-referenced with the opportunity for protection, restoration, and/or management of forested ridge and swale in each of the Ecological Landscapes (Tables 3-106 and 3-107).
- Using the analysis described above, a species was further selected if it had both a significant association with forested ridge and swale and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of forested ridge and swale. These species are shown in Figure 3-20.

Table 3-106. Vertebrate Species of Greatest Conservation Need that are (or historically were) *significantly* associated with forested ridge and swale communities and their association with Ecological Landscapes that support forested ridge and swale.

Forest Ridge and Swale		Birds (1)*	Herptiles (1)
Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type		Canada Warbler	Four-toed Salamander
MAJOR			
Central Lake Michigan Coastal			
Northern Lake Michigan Coastal			
PRESENT (MINOR)			
Superior Coastal Plain			

Color Key


-  = HIGH probability the species occurs in this Ecological Landscape
-  = MODERATE probability the species occurs in this Ecological Landscape
-  = LOW or NO probability the species occurs in this Ecological Landscape


* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.


Table 3-103. Vertebrate Species of Greatest Conservation Need that are (or historically were) *moderately* associated with forested ridge and swale communities and their association with Ecological Landscapes that support forested ridge and swale.

Forest Ridge and Swale	Birds (8)*								Mammals (1)
	Solitary Sandpiper	Black-billed Cuckoo	Olive-sided Flycatcher	Least Flycatcher	Veery	Wood Thrush	Brown Thrasher	Rusty Blackbird	Northern Flying Squirrel
MAJOR									
Central Lake Michigan Coastal									
Northern Lake Michigan Coastal									
PRESENT (MINOR)									
Superior Coastal Plain									

Color Key

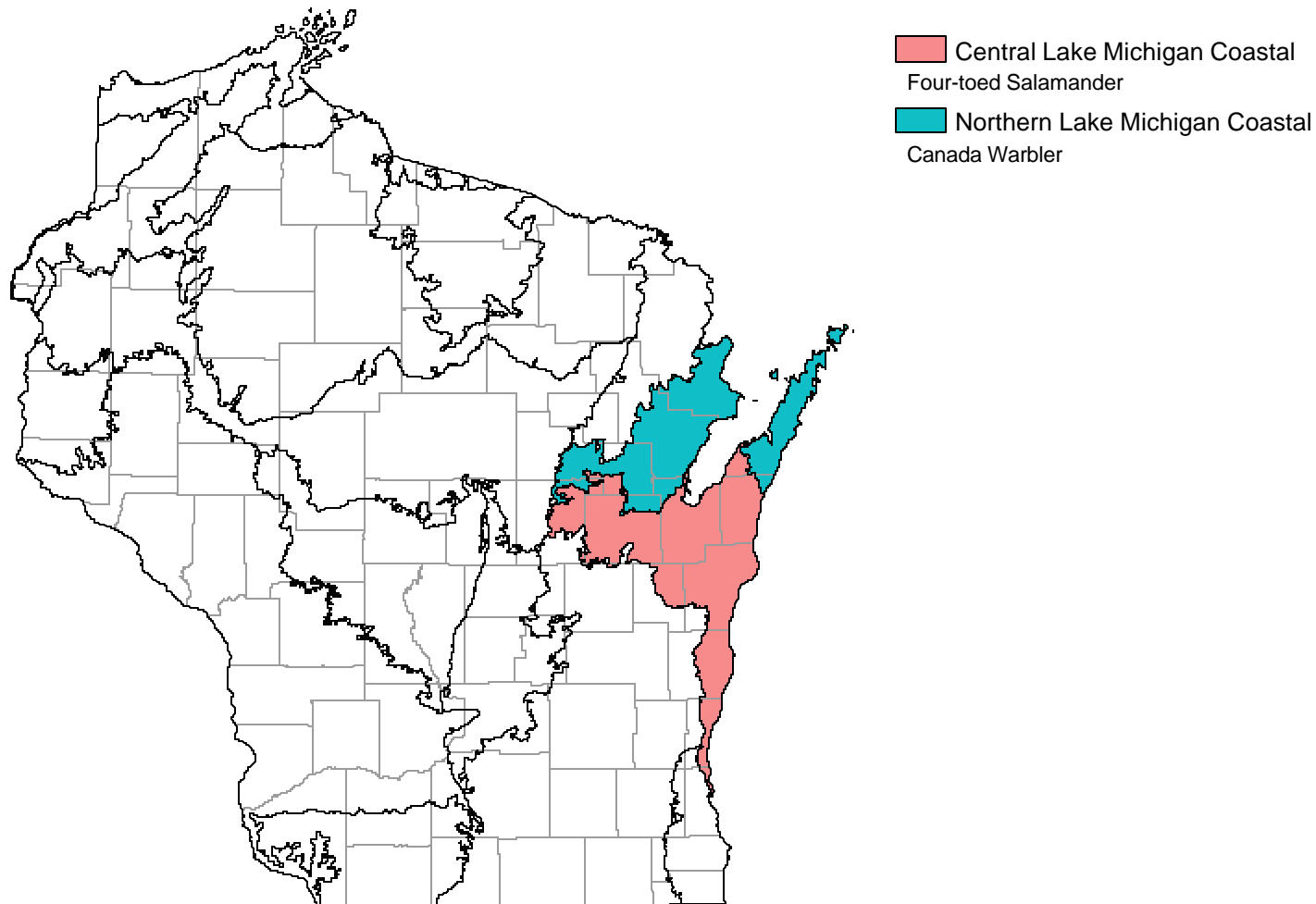
 = HIGH probability the species occurs in this Ecological Landscape

 = MODERATE probability the species occurs in this Ecological Landscape

 = LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Figure 3-20. Vertebrate Species of Greatest Conservation Need that have both a significant association with forested ridge and swale and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of forested ridge and swale.



3.3.4.6.3 Threats and Priority Conservation Actions for Forested Ridge and Swale

3.3.4.6.3.1 Statewide Overview of Threats and Priority Conservation Actions for Forested Ridge and Swale

The following list of threats and priority conservation actions were identified for forested ridge and swale in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.6.3.2 unless otherwise indicated.

Threats and Issues

- Threats to site hydrology are a major concern. These can come from road construction, residential development, beaver activity, ditching, or dredging.
- The communities are all vulnerable to colonization by highly invasive plants, such as giant reed in the open wetlands, glossy buckthorn in the lowland forests, and garlic mustard and Tatarian honeysuckle in the upland forests.
- Runoff from housing developments or agricultural lands can negatively impact hydrologic patterns and water quality.
- Unsustainable logging practices can affect the abundance of some species, damage fragile soils, exacerbate the spread of invasive plants, and disrupt hydrology.
- Long-term reduction in Great Lakes water levels may disrupt community function and alter composition of the wetlands, which are dependent upon periodic inundation by lake water.
- Excessive deer browse can be a significant threat to forest communities.
- Trampling from livestock or heavy foot traffic may harm some herbaceous species.

Priority Conservation Actions

- Manage as diverse complexes that are linked by hydrology, landform, and vegetation mosaic.
- Protect intact sites, and maintain or re-establish ecological connections to other sites of high value.
- Protect site hydrology and preserve the connections to the water sources that sustain this system.
- Conduct periodic checks for invasive plants and minimize the damage caused by any problem species.
- Use management techniques that limit spread of additional invasives.
- Continue to support research designed to identify effective biological controls for invasive species.
- Monitor deer browse levels and lower deer numbers, if possible.
- If forest management takes place, apply Best Management Practices and possibly additional practices as warranted to minimize detrimental soil and water effects.
- This community type is particularly sensitive to hydrologic disruption, and placing crossings through swales to gain access to ridges can easily impede hydrologic flow with long-lasting effects. This can be true of temporary winter crossings as well as more permanent roads. Ridges in this system are formed of lake sand, and can become unstable when vegetation is removed, leading to wind erosion and slumping of roadcut banks. These “blowout” areas are not easily revegetated.
- Manage recreational uses so they are compatible with protecting these community types (e.g., limiting erosion, controlling spread of invasives, preventing damage to sensitive hydrology, soils and vegetation).

3.3.4.6.3.2 Additional Considerations for Forested Ridge and Swale by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of forested ridge and swale exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for forested ridge and swale found in Section 3.3.4.6.3.1.

Additional Considerations for Forested Ridge and Swale in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Point Beach Ridges State Natural Area (Manitowoc County) is an exceptional example of a forested ridge and swale ecosystem. This site is partially protected by its inclusion within Point Beach State Forest and a private nature preserve. Grazing, dumping, and forest clearcutting has negatively affected parts of the larger wetland-dune complex. Another excellent example of a forested ridge and swale community occurs at Woodland Dunes State Natural Area (Manitowoc County).

Northern Lake Michigan Coastal

The Ridges Sanctuary State Natural Area (Door County) and several privately owned sites contain good examples of this community complex. The narrow ridges are forested with black spruce, white spruce, balsam fir, and eastern white pine with wet swales between the ridges. Swamp conifers occupy some of the swales; others are filled with marsh and bog flora. Sections of the forest can be classified as boreal and are similar to, but far disjunct from the northwestern Wisconsin boreal forests near Lake Superior. The cool water of Lake Michigan heavily influences the local climate, allowing many northern species to thrive.

Shivering Sands (Door County) is a large, diverse complex that occurs on the eastern side of the Door Peninsula along Lake Michigan. This site, like others on the Door Peninsula, is threatened by residential development, unsustainable logging practices, hydrologic disruption, the spread of invasive plants, and road construction. The conversion of farmland to homesites and subdivisions in the upper parts of the watershed poses potential challenges to conservation efforts directed toward maintaining the quality and quantity of surface and ground water downstream.

Additional Considerations for Forested Ridge and Swale in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Superior Coastal Plain

Great Lakes coastal ridge and swale systems occur near the mouth of the Bad River and in association with a coastal barrier across Chequamegon Bay.

3.3.4.7 Great Lakes Alkaline Rockshore

3.3.4.7.1 Community Overview

Great Lakes alkaline rockshore is a community that develops on creviced, wave-splashed, horizontal or gently sloping exposures of dolomite bedrock that dip toward Lake Michigan. These occur only along the Lake Michigan shoreline of the northern Door Peninsula, and on the margins of some of the Grand Traverse Islands, to the north. This is the same bedrock that forms the Niagara Escarpment which forms prominent cliffs on the west side of the Peninsula. The extent of the exposed rock is dependent on Lake Michigan water levels; large expanses of this habitat may be either inundated or exposed during a given year. Characteristic members of this community include the shrubs ninebark and shrubby cinquefoil, and the herbs silverweed, Arctic primrose, grass-leaved goldenrod, brook lobelia, gentians (*Gentiana* spp., *Gentianopsis* spp.), grasses-of-Parnassus, Indian paint-brush, low calamint, and many sedges and rushes. Plants endemic to the Great Lakes shores are significant components of some stands.

Because this community type is geographically restricted to those portions of the Lake Michigan coast with dolomite shoreline, it is, and has always been, rare here. Just inland of the exposed dolomite pavement there is often a narrow zone of rank herbs and tall shrubs, sometimes occupying a ridge of cobbles, gravel, or a low ledge. On the more stable habitats beyond this zone of herbs and shrubs, a very distinctive forest sometimes develops. Mature stands are usually composed of mixtures of northern white cedar, white spruce, balsam fir, eastern white pine, and paper birch.

3.3.4.7.2 Vertebrate Species of Greatest Conservation Need Associated with Great Lakes Alkaline Rockshore

There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately or significantly associated with Great Lakes alkaline rockshore.

3.3.4.7.3 Threats and Priority Conservation Actions for Great Lakes Alkaline Rockshore

All known occurrences of Great Lakes alkaline rockshore are in the Northern Lake Michigan Coastal Ecological Landscape. As a result, the Northern Lake Michigan Coastal Ecological Landscape represents a major opportunity for protection, management, and/or restoration of Great Lakes alkaline rockshore.

Off the northern tip of the Door Peninsula, some of the Grand Traverse Islands feature alkaline rockshore, and serve as important stops for migratory shorebirds. On the Door County mainland, Newport Beach State Park protects an extensive strip of this habitat, with splash pools and crevices providing microsites for rare plant species.

The following list of threats and priority conservation actions were identified for Great Lakes alkaline rockshore in Wisconsin.

Threats and Issues

- This community is adapted to a wide range of normal lake level fluctuations. Both the highs and lows in the water level cycles are necessary if the plants that occupy the exposed dolomite flats are to persist over time.
- Residential development pressure is increasing, and shoreline areas with a lake view are especially vulnerable. Lakeshore development is often accompanied by activities that can destroy elements of the plant community or habitat.
- Examples occur in areas that receive heavy recreational use, where physical damage to the surface vegetation can occur due to vehicles and heavy foot travel.

- Road construction and quarrying can destroy the bedrock shelves and crevices that retain soil, water and nutrients that support the unique vegetation and provide habitat for animals.
- The impacts of invasive species are unknown, but warrant investigation in regard to rare plant and invertebrate species.

Priority Conservation Actions

- Preservation of the natural variability of Lake Michigan's hydrologic cycles is a key to maintaining this community type. As of late 2004, the outlet of Lake Michigan (actually the Lake Huron outlet, where the combined waters of Lakes Michigan and Huron enter the St. Clair River near Detroit) has been in a long cycle of down-cutting, which has lowered the mean lake elevation by approximately one foot. Discussion is underway among various units of government regarding a long-term solution to this situation.
- Protection should be encouraged, especially on privately owned sites.
- Local zoning or the use of conservation easements may be effective ways to prevent incompatible activities.
- At the site level, protection should extend to the vegetative communities adjoining the shorelines.
- Effective conservation plans must account for the dynamic nature of Great Lakes ecosystems, over single seasons, decades, and centuries.
- Inform managers of public lands that contain this community of its significance, and share management information, particularly with respect to threats.
- Surveys should focus on documentation of ecological values of these unusual habitats, especially to plants and invertebrates, and perhaps to migratory birds. The non-vascular plants, especially, are in need of further study.

3.3.4.8 Great Lakes Beach

3.3.4.8.1 Community Overview

The Great Lakes Beach community occurs at the interface of land and water along the margins of Lakes Michigan and Superior, often in association with sparsely vegetated, semi-stabilized dune systems. Great Lakes beaches are extremely dynamic features, strongly influenced by water level changes and storm events. The lower beach is continually impacted by waves, the middle beach supports a dynamic plant community affected by wave action only during storms, and the upper beach, affected by wind-blown sand, wave spray, and only the most severe storms, supports a relatively diverse assemblage of plants.

The beach flora is typically sparse due to the scouring action of waves and ice. However, following several years of low water with few major storm events, the vegetation of the upper beach zone can become quite dense. Floristic composition can be an odd mix that includes globally rare endemics, as well as widespread weedy species adapted to quickly colonizing disturbed areas swept bare of competing vegetation. Exposed shorelines may be entirely unvegetated. Plants endemic to the shores of the Great Lakes, such as seaside spurge and American sea-rocket, are characteristic of some of the Lake Michigan beaches, especially during low water periods. Native associates may include silverweed, Baltic rush, and water horehound. The beaches of the Lake Superior region, though they are for the most part unvegetated, are important foraging, resting, and breeding areas for migratory and resident birds.

3.3.4.8.2 Vertebrate Species of Greatest Conservation Need Associated with Great Lakes Beach

Five vertebrate Species of Greatest Conservation Need were identified as significantly associated with Great Lakes beach (Table 3-108). There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately associated with Great Lakes beach communities.

Table 3-108. Vertebrate Species of Greatest Conservation Need that are (or historically were) significantly associated with Great Lakes beach communities.

Birds
Piping Plover
Whimbrel
Dunlin
Caspian Tern
Common Tern

In order to provide a framework for decision-makers to set priorities for conservation actions, the species identified in Table 3-108 were subject to further analysis. The additional analysis identified the best opportunities, by Ecological Landscape, for protection, restoration, and/or management of both Great Lakes beach and associated vertebrate Species of Greatest Conservation Need. The steps of this analysis were:

- Each species was examined relative to its probability of occurrence in each of the 16 Ecological Landscapes in Wisconsin. This information was then cross-referenced with the opportunity for protection, restoration, and/or management of Great Lakes beach in each of the Ecological Landscapes (Tables 3-109).
- Using the analysis described above, a species was further selected if it had both a significant association with Great Lakes beach and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of Great Lakes beach. These species are shown in Figure 3-21.

Table 3-109. Vertebrate Species of Greatest Conservation Need that are (or historically were) significantly associated with Great Lakes beach communities and their association with Ecological Landscapes that support Great Lakes beach.

Great Lakes Beach Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type	Birds (5)*				
	Piping Plover	Whimbrel	Dunlin	Caspian Tern	Common Tern
MAJOR					
Central Lake Michigan Coastal					
Northern Lake Michigan Coastal					
Superior Coastal Plain					
PRESENT (MINOR)					
Southern Lake Michigan Coastal					

Color Key

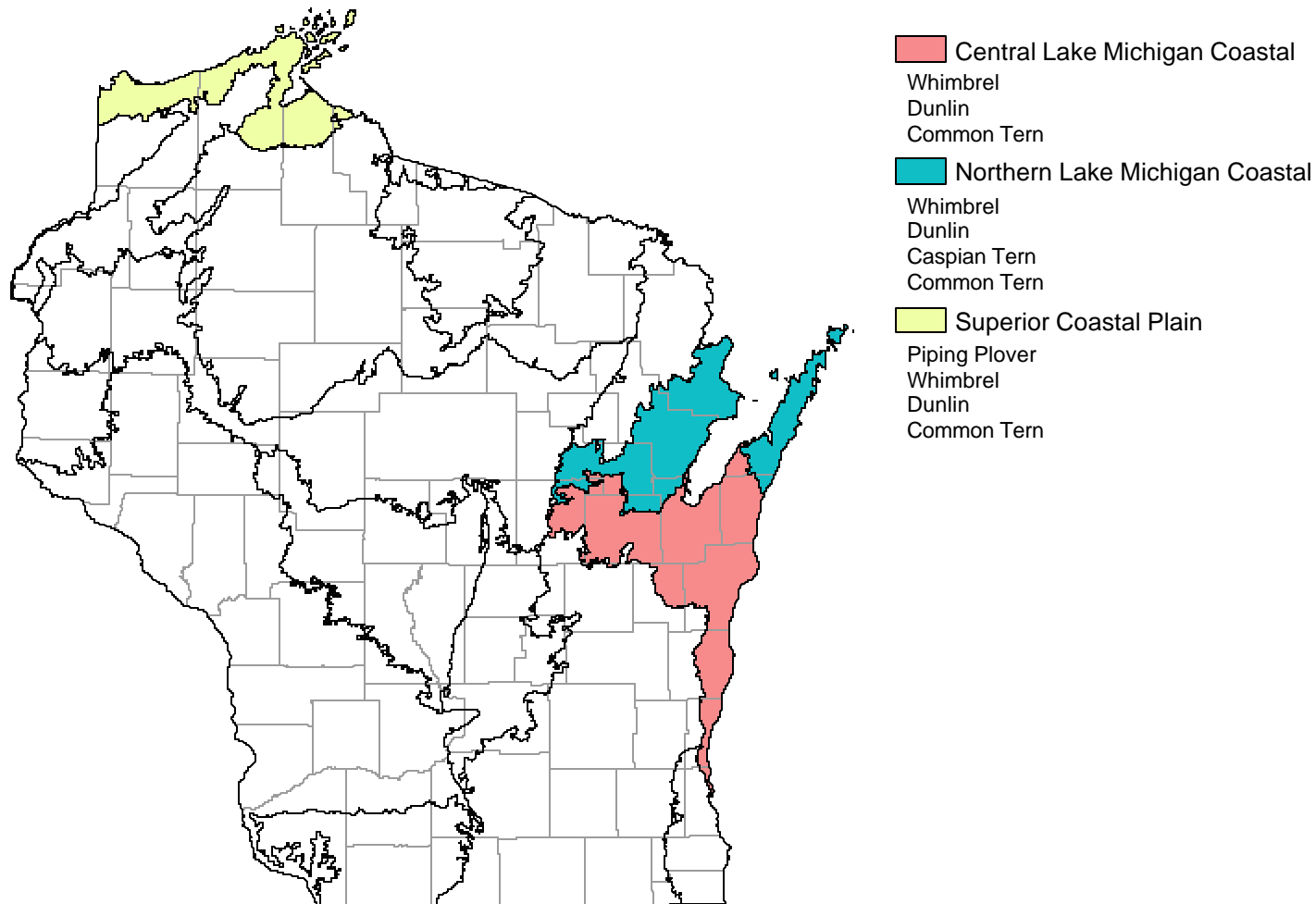
= HIGH probability the species occurs in this Ecological Landscape

= MODERATE probability the species occurs in this Ecological Landscape

= LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Figure 3-21. Vertebrate Species of Greatest Conservation Need that have both a significant association with Great Lakes beach and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of Great Lakes beach.



3.3.4.8.3 Threats and Priority Conservation Actions for Great Lakes Beach

3.3.4.8.3.1 Statewide Overview of Threats and Priority Conservation Actions for Great Lakes Beach

The following list of threats and priority conservation actions were identified for Great Lakes beach in Wisconsin. The threats and priority conservation actions described below apply to all Ecological landscapes in Section 3.3.4.8.3.2 unless otherwise indicated.

Threats and Issues

- Inadequate management of recreational use, including both motorized and foot traffic, can cause loss of vegetation or undue disturbance to sensitive wildlife species.
- Removal of woody debris, such as driftwood for fires and souvenirs, depletes invertebrate habitat.
- All-terrain vehicle (ATV) use crushes and uproots sensitive vegetation, in turn destroying animal habitat and leaving areas vulnerable to destructive levels of erosion.
- Sand mining can starve beaches and dunes of sand necessary for replenishment of dunes.
- Structures such as solid piers, seawalls, rip-rap, and jetties can interfere with the continual longshore drift needed to move sand along the lakeshore and replenish beaches.
- Artificial shoreline structures and hardening of the shoreline has interrupted the important process of longshore sediment transport that naturally erodes and replenishes sand beaches. Tons of sand must be brought in to artificially replenish beaches each year, primarily for recreational purposes.
- Vegetation removal, including vegetation that existed prior to decreases in lake levels.
- Use of herbicides can destroy populations of rare plants.
- Housing and other development can obliterate areas of this beach community, as well as fragment larger sites.
- Invasive species such as zebra mussel and (formerly) alewife can die by the millions, piling up in windrows several feet high and causing a major nuisance for beach users.
- Invasive plants such as purple loosestrife and common reed can invade beaches but are not generally persistent under normal disturbance regimes.
- High coliform bacteria counts constitute a major health threat.

Priority Conservation Actions

- Limiting of recreational activities, such as use of off-road vehicles and even hiking, may be necessary to prevent trampling of shallow-rooted vegetation and the introduction of invasive species.
- Lake level management should avoid prolonged periods of unusual, excessively high lake levels.
- Monitor affects of lake levels on the natural community and, in collaboration with other Great Lake states and provinces, develop options to address adverse changes as appropriate.
- Protect beach areas, including piping plover nesting areas, using "Environmental Area" (or "Critical Dune Area" if dunes are present) designations (as currently used in Michigan).
- Educate landowners about the adverse affects of activities such as sand mining, excessive mowing, and raking or otherwise uprooting vegetation, including endangered species, from middle-beach and upper-beach areas. Establish conservation incentives and restrictions as needed.
- Implement or continue voluntary programs to monitor for and aggressively eliminate invasive species.
- Work with willing private landowners on agreements to protect relatively undisturbed areas where possible.

3.3.4.8.3.2 Additional Considerations for Great Lakes Beach by Ecological Landscape.

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of Great Lakes beach exist. Those

considerations are described below and are in addition to the statewide threats and priority conservation actions for Great Lakes beach found in Section 3.3.4.8.3.1.

Additional Considerations for Great Lakes Beach in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Point Beach State Forest protects 6 miles of beaches and dunes, which are associated with a complex system of ridges and swales that parallel the Lake Michigan shoreline. Harrington Beach and Kohler-Andrae State Parks protect additional undeveloped shoreline habitats but receive very heavy human visitation during the summer months.

Northern Lake Michigan Coastal

Several examples occur along the west shore of Green Bay, including at Seagull Bar and Peshtigo Harbor. Whitefish Dunes, Rock Island, and Newport State Parks contain important examples of this habitat. Significant populations of rare plants are known from several of these sites.

Superior Coastal Plain

Most beaches on Lake Superior are associated with Great Lakes coastal landforms such as barrier spits, baymouth bars, tombolos, and cusped forelands. The Apostle Islands National Lakeshore protects several miles of undeveloped beach. At several locations small beaches arch between rocky headlands. The beaches of the Apostle Islands and Chequamegon Bay are important staging areas for migratory birds, and provide critical nesting habitat for shorebirds. Wilderness designation, currently under consideration at the National Lakeshore, could add further protection to several of these sites.

Bark Bay Slough, Port Wing Boreal Forest, and Lost Creek Bog are State Natural Areas managed by the WDNR that feature beaches protected by sand bars. Significant beaches occur on tribal lands under the stewardship of the Bad River and Red Cliff bands of Lake Superior Ojibwa. A more disturbed but extensive area of Great Lakes beach occurs at Wisconsin Point, a coastal barrier spit at the mouth of the St. Louis River. Additional beach areas lie at scattered spots along the southern Lake Superior coast from Wisconsin Point to the Montreal River, nearly 150 miles to the east.

Additional Considerations for Great Lakes Beach in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

No Ecological Landscapes with important opportunities were identified. However, Great Lakes beach was formerly an important shoreline feature in the Southern Lake Michigan Coastal Ecological Landscape, especially near the present day cities of Kenosha, Racine, and Milwaukee. Where beaches still occur in these locales, they have been affected by many developments and receive heavy human visitation during the summer months. Even so, they can provide important habitat for migratory birds.

3.3.4.9 Great Lakes Dune

3.3.4.9.1 Community Overview

Overall, Great Lakes dune flora is an odd mix of geographically restricted habitat specialists and weedy generalists. Among the specialists are a number of endemic plants and animals, some of which occur in no other habitat and in no other region of North America. Others occur wherever dunes occur in eastern North America, including marine environments along the Atlantic Ocean coast.

Among the relatively few plants that are able to successfully colonize active, unvegetated dunes are several drought resistant perennial grasses that produce tough, sand binding rhizomes. Especially important are marram grass, the most prevalent dominant species in Great Lakes dune systems, sand reed, wheatgrass, crinkled hairgrass, and Canada wild rye. Associated vascular plants include beach pea, field sage-wort, common evening-primrose, common milkweed, and a long list of weedy native and exotic species (Curtis 1959).

3.3.4.9.2 Vertebrate Species of Greatest Conservation Need Associated with Great Lakes Dune

Two vertebrate Species of Greatest Conservation Need were identified as significantly associated with Great Lakes dune (Table 3-110). There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately associated with Great Lakes dune communities.

Table 3-110. Vertebrate Species of Greatest Conservation Need that are (or historically were) significantly associated with Great Lakes dune communities.

Birds
Piping Plover
Mammals
Franklin's Ground Squirrel

In order to provide a framework for decision-makers to set priorities for conservation actions, the species identified in Table 3-110 were subject to further analysis. The additional analysis identified the best opportunities, by Ecological Landscape, for protection, restoration, and/or management of both Great Lakes dune and associated vertebrate Species of Greatest Conservation Need. The steps of this analysis were:

- Each species was examined relative to its probability of occurrence in each of the 16 Ecological Landscapes in Wisconsin. This information was then cross-referenced with the opportunity for protection, restoration, and/or management of Great Lakes dune in each of the Ecological Landscapes (Tables 3-111).
- Using the analysis described above, a species was further selected if it had both a significant association with Great Lakes dune and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of Great Lakes dune. These species are shown in Figure 3-22.

Table 3-111. Vertebrate Species of Greatest Conservation Need that are (or historically were) *significantly* associated with Great Lakes dune communities and their association with Ecological Landscapes that support Great Lakes dune.

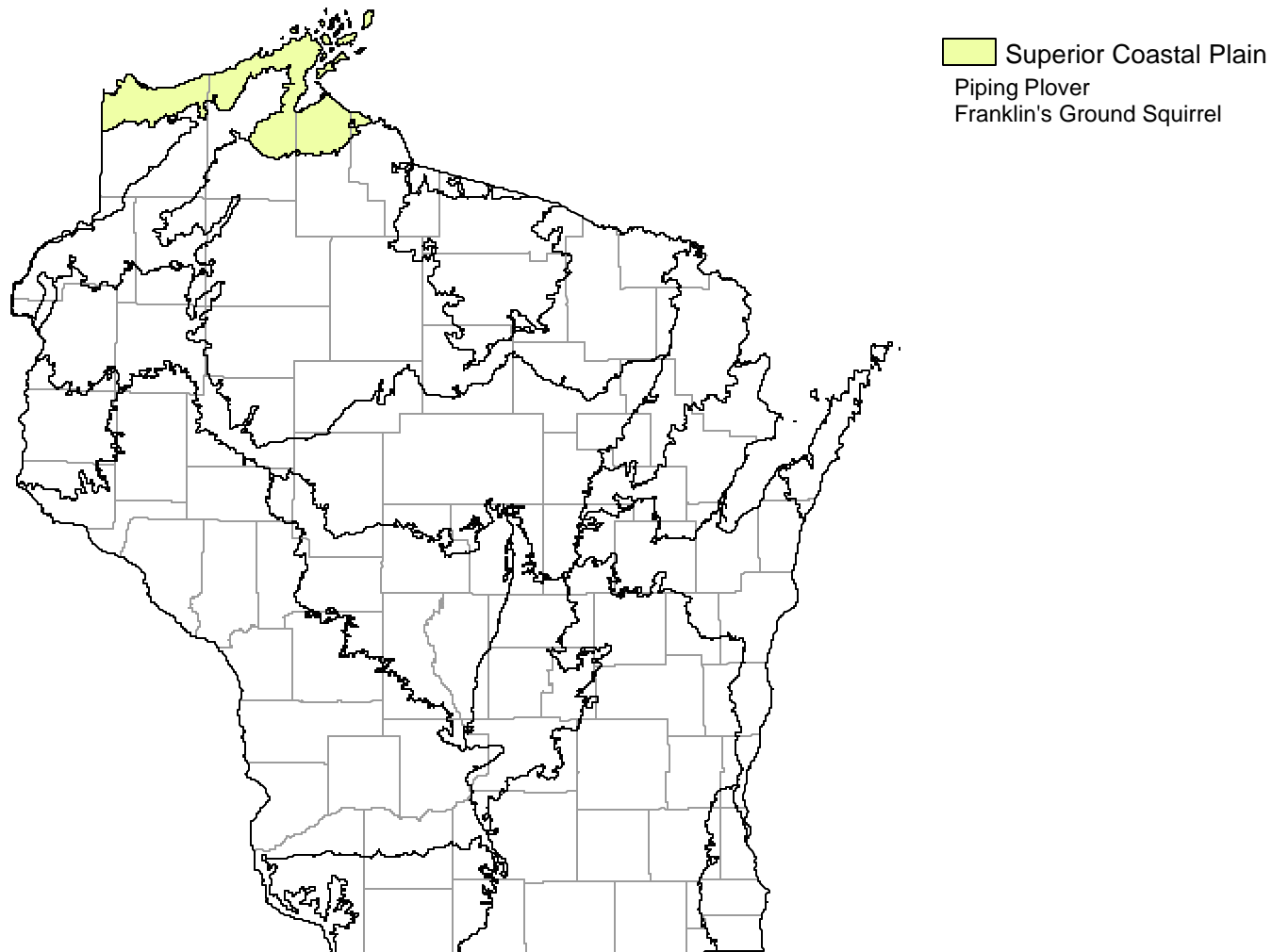
Great Lakes Dune	Birds (1)*	Mammals (1)
Ecological Landscape grouped by opportunity for management, protection, and/or restoration of this community type	Piping Plover	Franklin's Ground Squirrel
MAJOR		
Central Lake Michigan Coastal		
Northern Lake Michigan Coastal		
Superior Coastal Plain		
IMPORTANT		
Southern Lake Michigan Coastal		

Color Key

	= HIGH probability the species occurs in this Ecological Landscape
	= MODERATE probability the species occurs in this Ecological Landscape
	= LOW or NO probability the species occurs in this Ecological Landscape

* The number shown in parentheses is the number of Species of Greatest Conservation Need from a particular taxa group that are included in the table. Taxa groups that are not shown did not have any Species of Greatest Conservation Need that met the criteria necessary for inclusion in this table.

Figure 3-22. Vertebrate Species of Greatest Conservation Need that have both a significant association with Great Lakes dune and a high probability of occurring in an Ecological Landscape(s) that represents a major opportunity for protection, restoration and/or management of Great Lakes dune.



3.3.4.9.3 Threats and Priority Conservation Actions for Great Lakes Dunes

3.3.4.9.3.1 Statewide Overview of Treats and Priority Conservation Actions for Great Lakes Dune

The following list of threats and priority conservation actions were identified for Great Lakes dunes in Wisconsin. The threats and priority conservation actions described below apply to all Ecological landscapes in Section 3.3.4.9.3.2 unless otherwise indicated.

Threats and Issues

- Jetties, seawalls, and rip-rap can stabilize shorelines to the point where the sediments needed to replenish and build the dunes are no longer available.
- The presence of exotic (introduced non-native) plants and animals, especially those that are deemed “invasive” have the ability to spread rapidly and overwhelm populations of native species.
- Some native plants can become “invasive” under altered disturbance regimes, and have similarly negative impacts to more sensitive native biota. The dominance of poison ivy in heavily used dune areas is an example of this.
- Off-road vehicle (ORV) use, pedestrian recreational overuse, residential development, road construction, tree planting, and sand mining or other industrial development can also be problems.
- Removal of native vegetation by any means prevents the accumulation of sand and robs dunes of their potential or existing height.
- Pets, such as dogs, can disrupt nesting, resting and foraging birds, if they are allowed to run loose in sensitive areas.
- Overuse can accelerate erosion, destroy plant life, and damage habitat for specialized animals. Constructing buildings and roads, and using off-road motor vehicles in dune areas are particularly damaging.

Priority Conservation Actions

- Development of “Critical Dune Area” or “Environmental Area” designations (as currently used in Michigan) could be useful tools to protect dune systems from destructive activities such as sand mining, excessive mowing, uprooting of endangered plant species, and raking live vegetation from dunescape areas. Such designations would require the passage of state legislation or county ordinances.
- Implement or continue voluntary programs to monitor for and aggressively eliminate invasive species.

3.3.4.9.3.2 Additional Considerations for Great Lakes Dune by Ecological Landscape.

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of Great Lakes beach exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for Great Lakes dunes found in Section 3.3.4.9.3.1.

Additional Considerations for Great Lakes Dune in Ecological Landscapes with *Major* Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Kohler-Andre State Park contains one of Wisconsin's best-developed dune systems. Great effort has been expended in recent years to protect the dunes from overuse, stabilize blowouts, and control or remove

invasive or otherwise unwanted vegetation. Coastal dunes also occur on adjacent private lands, which may offer ecological opportunities for additional protection.

Northern Lake Michigan Coastal

Public lands that feature examples of Great Lakes dune include Whitefish Dunes and Newport Beach State Park. Nearby, the 'Shivering Sands' area, from Cave Point County Park to Rocky Point (south of the Sturgeon Bay ship canal), contains some high-quality dunes. Seagull Bar, on the West Shore of Green Bay, at the mouth of the Menominee River near Marinette, contains very small areas of low dune vegetation.

Superior Coastal Plain

Lake Superior dunes are seldom more than a few meters high, but can be associated with special landforms (e.g., coastal barrier spits, baymouth bars, tombolos) that can sometimes extend for miles. Wisconsin Point, a coastal barrier spit at the mouth of Lake Superior on the western end of the lake, features several miles of low dunes, along a narrow zone between an unvegetated beach and a linear forest of pines. Developments on the barrier spit include an access road, seawall along an artificial channel that now separates the states of Wisconsin and Minnesota, and a Coast Guard facility. This site is justly famed for the large numbers and high diversity of migratory birds it attracts, including many rarities.

Beach and low dune complexes are also prominent features at several embayments along the northern margin of the Bayfield Peninsula, and in association with sandspits on the Apostle Islands. The Bad River and Red Cliff Bands of Lake Superior Ojibwa are stewards of significant Great Lakes shorelines that include dune systems and related features. Long Island-Chequamegon Point, an extensive barrier spit that crosses several miles of Chequamegon Bay, contains the most intact and extensive area of beach and dune on western Lake Superior.

Additional Considerations for Great Lakes Dune in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Southern Lake Michigan Coastal

Chiwaukee Prairie State Natural Area and adjacent Carol Beach protect about 0.3 miles of dune ecosystem, including many rare plant species. However, in this landscape the Lake Michigan shoreline has been heavily developed, with extensive seawalls, large jetties, and long stretches of riprap, covering the former beaches and isolating the dunes from their primary source of sand. Long-term viability of the dunes here is doubtful, without major intervention and augmentation. More viable protection options for beach and dune habitats may occur just to the south of Wisconsin, at Illinois Beach State Park. Scattered small pockets of dune exist at a few other locations. These need additional evaluation to determine whether or not they are worthy of conservation action.

3.3.4.10 Inland Beach

3.3.4.10.1 Community Overview

The beaches of inland lakes that experience enough water level fluctuation to prevent the development of a stable shoreline forest or other communities may instead support a specialized biota adapted to sandy or gravelly littoral habitats. The shorelines of such lakes (usually seepage lakes) may be subject to fluctuations of as much as several meters over a few years or decades.

Seepage lakes have neither a significant inlet nor outlet, and are fed by precipitation and groundwater. These lakes often have long residence times, and lake levels fluctuate with local groundwater levels and precipitation cycles. Seepage lakes lose water through evaporation and groundwater moving on a downslope gradient. The alternation of high and low periods maintains populations of the beach specialists over time, including some rare species of unusual geographic affinity, such as the Atlantic Coastal Plain of the eastern United States. A number of lakes in the Northwest Sands, Central Sand Hills, and Northern Highland Ecological Landscapes experience the lake level fluctuations necessary to support this community.

3.3.4.10.2 Vertebrate Species of Greatest Conservation Need Associated with Inland Beach

There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately or significantly associated with inland beaches.

3.3.4.10.3 Threats and Priority Conservation Actions for Inland Beach

3.3.4.10.3.1 Statewide Overview of Threats and Priority Conservation Actions for Inland Beach

The following list of threats and priority conservation actions were identified for inland beach in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.10.3.2 unless otherwise indicated.

Threats and Issues

- Seepage lakes with hard bottom materials, upland shorelines, and little groundwater inflow tend to be susceptible to the effects of acid rain, which could affect some of the beach plants that spend part of their life cycles in the water.
- Groundwater quality and the use of land on the shoreline can both affect water quality. Therefore, long residence times can mean that pollutants introduced into the system can remain for long periods.
- Lake level stabilization measures can reduce or cause the loss of this community.
- Shoreline development and other drivers of both heavy shoreline usage and hydrologic disruption can damage plant community structure and alter runoff characteristics.
- Physical damage (trampling, rutting, compaction) to the plant community can occur due to use by livestock and vehicles, and from heavy foot travel.
- Road construction and quarrying may alter the hydrology of the lakeshed, resulting in loss of the water level fluctuations necessary to maintain this community.
- The impacts of invasive species have not been well studied for this community type, but warrant investigation in regard to impacts on rare plant and invertebrate species.

Priority Conservation Actions

- Undeveloped examples of inland beach communities are limited in extent and should be the target of future inventory efforts in appropriate landscapes.

- This type is now found mostly on smaller lakes with little development, and on a few large lakes that have been held by a small number of owners.
- Some of the associated plant species are globally rare.
- Public property management plans should recognize the fragility of this type and the highly specialized nature of some of the organisms that are dependent on them.
- Additional protection is needed across the range of this type in Wisconsin.
- Preservation of the natural hydrologic regime requires managing land areas in the lakeshed to maintain water infiltration, overland inflow, and the natural cycle of water level changes.
- Prevent groundwater contamination.
- Continue air quality management programs that have led to a reduction in the precursors of atmospheric acid deposition.

3.3.4.10.3.2 Additional Considerations for Inland Beach by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of inland beach exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for inland beach found in Section 3.3.4.10.3.1.

Additional Considerations for Inland Beach in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

Northwest Sands

Lakes in the Northwest Sands continue to face increasingly heavy development pressure for year-round and seasonal homes, especially from the Twin Cities metropolitan area. Rush Lake (Douglas County), Richart Lake (Burnett County), Cloverleaf Lake (Washburn County), Deer Print Lake (Douglas County), and Goose Lake Beach (Douglas County) harbor good examples of this type. Lake associations led by lake protection advocates may be able to play a key role in limiting incompatible land uses.

Additional Considerations for Inland Beach in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Central Sand Hills

The majority of lakes in this Ecological Landscape have been heavily developed. East Lake (Portage County), Scout Lake (Columbia County), as well as Chain Lake and Silver Lake (both Waushara County) contain good examples of inland beach. A number of rare plant species have been documented in the beach communities in this Ecological Landscape.

North Central Forest

This Ecological Landscape is also very popular for recreational and retirement lakeshore home development. Kentuck Lake Swale (Vilas County) and Mountain Lake (Bayfield County) on the Chequamegon-Nicolet National Forest hold examples of this community type.

Northeast Sands

A few additional occurrences of this community are known from lakeshores in the Northeast Sands Ecological Landscape, but additional information is needed to assess them adequately.

Northern Highland

Lake development ranges from moderate to very intensive on most lakes in this Ecological Landscape that can be reached by road. A number of lakes enjoy advocacy from lake association members and leaders. This community occurs at a number of lakes within the Northern Highland-American Legion State Forest, including Salsich Lake, Bittersweet Lakes State Natural Area, and on the east side of Trout Lake (all Vilas County).

3.3.4.11 Moist Cliff

3.3.4.11.1 Community Overview

This community (often found on "micro-sites" of very restricted spatial extent) occurs on shaded (by trees or the cliff itself because of aspect), moist to seeping mossy, vertical exposures of various rock types. The most common rock types are sandstone and dolomite. A greater proportion of sandstone cliff sites tend to be moist, compared to limestone cliff sites, due to the potential for capillary action in sandstone to transport water essential for plant survival. Igneous (granite, basalt) and metamorphic (quartzite) rocks tend to be dry due to their impermeability, but in some situations water moving through the ground above the bedrock cannot go through the rock and moves laterally until it finds a path to take it downward. There it will exit, often over the face of a cliff.

Common vascular plant species include columbine, the fragile ferns (*Cystopteris bulbifera* and *C. fragilis*), wood ferns, rattlesnake-root, and wild sarsaparilla. The rare flora of these cliffs vary markedly in different parts of the state; Driftless Area cliffs might have northern monkshood, those on Lake Superior, butterwort, or those in Door County, green spleenwort. Lichens, mosses, and ferns are important components of cliff habitats. Present knowledge of the distribution and status of many of these plant species is limited. The same is true for many invertebrate species.

3.3.4.11.2 Vertebrate Species of Greatest Conservation Need Associated with Moist Cliff

There were not any vertebrate Species of Greatest Conservation Need that were identified as moderately or significantly associated with moist cliff.

3.3.4.11.3 Threats and Priority Conservation Actions for Moist Cliff

3.3.4.11.3.1 Statewide Overview of Threats and Priority Conservation Actions for Moist Cliff

The following list of threats and priority conservation actions were identified for moist cliff in Wisconsin. The threats and priority conservation actions described below apply to all of the Ecological Landscapes in Section 3.3.4.11.3.2 unless otherwise indicated.

Threats and Issues

- Loss of shading vegetative cover, by logging or other means, can result in desiccation of the cliff face.
- Quarrying destroys the bare rock communities by removing the substrate, although this might also expose and open new rock faces to colonization by plants.
- Unsustainable grazing can disrupt vegetation above cliffs, at the base of cliffs, or along broad ledges.
- Residential construction, road building and quarrying may affect hydrology and water transport to or through the bedrock and contribute to desiccation.
- Physical damage to the surface above the cliffs occurs due to livestock, vehicles, and heavy foot travel.
- Recreational activities such as rock climbing can directly damage the fragile plant growth clinging to the cliff face.
- The impacts of invasive species are unknown, but warrant investigation in regard to impacts on rare plant and invertebrate species.

Priority Conservation Actions

- A broader and more systematic approach to surveying, describing, and evaluating cliff habitats is needed.
- Setting conservation priorities is difficult unless something of exceptional value is already known to occur at a given site. This has been done in a few areas (e.g., on the Apostle Islands, in the Upper Kickapoo River Valley, in parts of the Penokee Range, and on some stretches of the Niagara Escarpment) but knowledge gaps remain significant.
- Limit or avoid grazing, quarrying, and other disruptive activities on high-value sites.
- Evaluate and seek to limit activities that could cause hydrologic disruption.
- Landowner education can succeed in helping to guide extractive and potentially high-impact recreational or grazing activities to less sensitive areas on private property.
- Some cliff-associated snail species are globally rare. The best sites for them, with the exception of state parks, appear to be privately owned. Protection should be encouraged on both public and privately owned sites.
- Surveys should be continued to search for additional sites, especially in counties where bedrock outcrops are either composed of rock that transmits water, or shaded by heavy vegetation, or exposed to the north.
- Public and private conservation organizations should work with private landowners to encourage protection of ecologically valuable sites, and support additional surveys to better assess cliff habitats.

3.3.4.11.3.2 Additional Considerations for Moist Cliff by Ecological Landscape

Special considerations have been identified for those Ecological Landscapes where major or important opportunities for protection, restoration, and/or management of moist cliff exist. Those considerations are described below and are in addition to the statewide threats and priority conservation actions for moist cliff found in Section 3.3.4.11.3.1.

Additional Considerations for Moist Cliff in Ecological Landscapes with **Major** Opportunities for Protection, Restoration, and/or Management

North Central Forest

Cliffs are not major features of this Ecological Landscape, but some exceptional examples occur in the Penokee Range of Iron and Ashland counties, e.g., along the Marengo and Brunsweiler Rivers. Other important moist cliff exposures occur along the Brule River within the Chequamegon-Nicolet National Forests (Florence County). Additional examples occur in the Flambeau Pines/Turtle River Hemlocks (Vilas County).

Superior Coastal Plain

Sandstone cliffs on Lake Superior islands (Ashland County) are protected to a high degree within Apostle Islands National Lakeshore. Otter Island, Devils Island, and Stockton Island all contain ecologically important series of moist cliff habitat. The mainland unit of the National Lakeshore (Bayfield County) also contains excellent, protected exposures of moist cliff.

Western Coulee and Ridges

Development of bluff lands in this Ecological Landscape has been increasing, spurred by an increase in the region's popularity for second homes and by exurban development from the LaCrosse and Madison metropolitan areas. Lodde's Mill Bluff and Parfrey's Glen State Natural Areas (Sauk County), Wyalusing

State Park (Grant County), and Wildcat Mountain State Park (Vernon County) contain excellent examples of this community. Many other occurrences exist on public and private lands in this Ecological Landscape.

Additional Considerations for Moist Cliff in Ecological Landscapes with **Important** Opportunities for Protection, Restoration, and/or Management

Central Lake Michigan Coastal

Land use plans covering this area as of 2001 largely excluded the Niagara Escarpment as a unique natural feature. Overlapping and sometimes conflicting plans among jurisdictions can create a barrier to effective cooperation on conservation issues. Neshoto Caves and Dells (Manitowoc County), along with Escarpment Woods (Brown County), are just two of the moist cliff sites in this Ecological Landscape. An ongoing project to inventory the Niagara Escarpment may reveal additional sites worthy of protection.

Central Sand Hills

Increased scattered residential development is becoming a factor here, but is not likely to affect this community. Pine Hollow State Natural Area (Sauk County) and Petra's Ravine feature shaded moist cliffs supporting plants such as sword moss and Sullivan's coolwort.

Central Sand Plains

Upper Dells Cliffs (Columbia County) supports one of only a few globally known populations of cliff cudweed. Blackhawk Island and Castle Rock (Juneau County) are two other well-known and protected examples of moist cliff in this Ecological Landscape

Forest Transition

Dalles of the St. Croix River State Natural Area (Polk County) primarily features dry cliff along an exposed basalt formation, but there is also some moist cliff in this protected area. Dells of the Eau Claire River (Marathon County) is a county-owned State Natural Area where spray from water tumbling through a rhyolitic schist gorge sustains a moist cliff community.

Northern Lake Michigan Coastal

Red Banks Glades (Brown County) contains some of this type, and is in need of prompt conservation attention due to a combination of threats. Washington Island, Plum Island and Rock Island (all Door County) contain examples of this type that enjoy varying degrees of protection.

Northeast Sands

Club Moss Woods (Marinette County) is one site in this Ecological Landscape that may be worthy of conservation action.

Southeast Glacial Plains

Mitchell's Glen (Fond du Lac County) is a moist cliff site that received a high score for ecological significance at a workshop held to identify conservation priorities in the Upper Fox Basin.

Southwest Savanna

Most of the known sites are in private ownership.

Western Prairie

Kinnickinnic River Gorge and Delta (Pierce County) features a high, dripping sandstone shelf with a population of bulblet ferns, among many other characteristic cliff plants. The steep, high, narrow sandstone formation of the Apple River Canyon State Natural Area (St. Croix County) supports another protected example of this community.